**Ms. Ottolini’s Cheat Sheet to Osmosis Problems**

AP Biology

When answering cell transport problems, you will often be asked to do one of two things:

1) Identify a solution as hypotonic, hypertonic, or isotonic (as compared to another solution)

2) Predict the direction of water movement or solute movement

When completing the first of these two tasks, identify the solutions as hypotonic, hypertonic, or isotonic BEFORE any water or solute has moved across the semipermeable membrane to achieve equilibrium (equal solute and water concentrations) between the two solutions. Please remember the definitions for each of the following solutions (as compared to another solution).

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Hypotonic** | **Hypertonic** | **Isotonic** |
| **Water Concentration** | High | Low | Same |
| **Solute Concentration** | Low | High | Same |

Because water should always move from a high water concentration to a low water concentration, water always moves from a hypotonic solution to a hypertonic solution.

When completing the second of these two tasks, remember that water always moves from a high water concentration to a low water concentration, and solute always moves from a high solute concentration to a low solute concentration. Be sure you know which substances can move across the semipermeable membrane. If the membrane is NOT permeable to a solute, it cannot move across the membrane from a high solute concentration to a low solute concentration.

**Example Problems:**

1. Celery stalks that are immersed in fresh water for several hours become stiff and hard. Describe the solution inside the celery stalk as hypotonic, hypertonic, or isotonic to the fresh water, and identify the direction of water movement (into or out of the celery cells).



If the celery stalks become stiff and hard, water is moving into the celery cells. Since water always moves from a high water concentration to a low water concentration, we can infer that the fresh water has a high water concentration and the solution inside the celery cells has a low water concentration (comparatively speaking). If the solution inside the celery cells has a low water concentration, we can classify it as a hypertonic solution (compared to the freshwater outside solution).



2. Celery stalks that are immersed in a 0.15 *M* salt solution become limp and soft. Describe the solution inside the celery stalk as hypotonic, hypertonic, or isotonic to the salt solution, and identify the direction of water movement (into or out of the celery cells).

If the celery stalks become limp and soft, water is moving out of the celery cells. Since water always moves from a high water concentration to a low water concentration, we can infer that the solution inside the celery cells has a high water concentration and the salt solution has a low water concentration (comparatively speaking). If the solution inside the celery cells has a high water concentration, we can classify it as a hypotonic solution (compared to the saltwater outside solution).

